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GENERAL SITE CHARACTERISTICS AND BASIC DATA NEEDS FOR THERMAL POWER PLANT SITE EVALUATION

Federal Water Pollution Control Administration
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Northwest Region
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GENERAL SITE CHARACTERISTICS AND BASIC DATA NEEDS FOR THERMAL POWER PLANT SITE EVALUATION

INTRODUCTION

Thermal power plant siting in the Northwest to date has lacked adequate consideration of aquatic environmental aspects. ~~Typically~~, site safety and economics have been primary considerations. The Federal Water Pollution Control Administration (FWPCA) considers that aquatic environmental aspects are equally important and that the absence of adequate and definitive guidelines has been largely responsible for this lack of consideration. Therefore, early coordination of power plant siting studies with State and Federal regulatory agencies is an urgent necessity.

This document describes ~~those~~ data which are necessary for satisfactory evaluation of selected power plant sites, relative to applicable Water Quality Standards and FWPCA policy statements on thermal power plant siting. It is presumed that the needed data will be provided and evaluated by the power company(ies) with respect to effects on the aquatic environment in their site selection report. Associated field studies will include at least two years of measurements acceptable to FWPCA.

Where available data and/or techniques are inadequate to define the impact of power plant operation upon the aquatic environment, it is presumed that waste discharge permit decisions will favor protection of the environment.

Development of these guidelines is based upon the following general site characteristics which are prerequisite to the protection of the aquatic environment and water resource users:

1. Marine sites considered by the power company(ies) must be separated from major shellfish areas and fish migration routes by a sufficient distance to avoid adverse effects.

2. Applicable Water Quality Standards must be complied with. Outfall dilution zones, beyond which temperatures are less than 0.5^{o} F. above ambient, must not adversely influence confined fish migration routes.

3. Adequate depth must be available so that power plant intakes do not adversely endanger aquatic organisms near the water surface.

4. The area of concern referred to in the following outline is defined as an area of at least a five-mile radius from the power plant intake/outfall.

PRELIMINARY SITE EVALUATION DATA NEEDS

1. Marine Power Plant Sites

The following data will be necessary for evaluation of coastal and estuary sites:

A. Power Plant Data

(1) Specific location of the site.

(2) Description of other important water uses within the area of concern; but at least within five miles of the power plant site.

(3) Generating capacity (initial and ultimate); projected power generation schedules for representative years over the expected life of the project.

(4) Fuel and thermal efficiency.

(5) Cooling water requirements for alternate modes of waste heat treatment.

(6) Recommendations on specific power plant intake/outfall design and location; also, recommendations on screening and fish by-pass facilities, cooling water pump types and sizes, and condenser cooling line sizes.

(7) Mode of waste heat treatment. Information should be presented to show that potential avenues for waste heat utilization have been seriously considered.

(8) Mode of fouling control in the intake/outfall conduits and the condenser cooling water lines.

(9) Characteristics and methods of handling and disposal for general plant wastes other than condenser cooling water.

B. Physical Oceanographic Data

The utilities are expected to calculate the mixing characteristics of discharges from the power plant outfall(s) and present the data, methods of calculation, and results in their preliminary site selection report.

(1) Determinations of surface area and total volume of water affected by outfall discharge, within which temperatures are at least 0.5^{o} F. higher than ambient water temperatures. Also,

determinations of the mass transport of the warm water field with time (viz., flushing characteristics).

These calculations will be made for critical conditions of tides, slack current conditions, weather, and possible influence of fresh water flows.

(2) Bottom contours (depth below MLLW) within five miles of the probable power plant intake/outfall locations.

(3) Tidal characteristics, daily and seasonally (i.e., ranges of depth with time).

(4) Ambient currents within the area of concern: (a) direction and strength of the current as functions of time, tides, offshore currents, wind conditions, and possible influence of fresh water flows; (b) occurrence and duration of periods of minimum current speed; (c) occurrence and duration of periods of upwelling.

(5) Ambient water temperatures within five miles of the power plant intake/outfall. In developing these data, it is important to note that the Water Quality Standards for coastal waters apply at least to the three-mile limit and to the entire water column. The dispersion, or dilution zone is excepted, from the numerical criteria, but only after the waste has received adequate treatment and has been provided with satisfactory initial dispersion.

Specifically, surface isotherm maps, accurate to at least 1^{o} F., are needed and should define temperature changes diurnally and seasonally. Temperature profiles are needed at one-half mile grid intervals within the five-mile study area, and should define

variations with time. Finally, a continuous record of temperature is needed for one profile near the proposed power plant outfall. It is expected that these continuous records will show the influence of nearshore current movement, upwelling, and other phenomena of mass water transport on water temperatures at a point.

(6) Salinity profiles are also needed at one-half mile intervals to complete evaluation of receiving water density characteristics with time.

C. Meteorological Data

The following continuous records will be required at the plant site for correlation with long term regional data: wind speed and direction, air temperature, dewpoint, and solar radiation.

D. Biological Data

Since the Water Quality Standards for coastal waters were developed largely upon the need for preservation of marine organisms, careful documentation of the receiving water biota is essential.

(1) An inventory of pelagic and benthic organisms identified at least to genera is required within five miles of the nuclear thermal power plant intake/outfall. Emphasis should be placed on pelagic organisms and results presented in terms of estimated percent distribution and relative abundance of the important genera. These data should be taken to describe vertical and horizontal distribution and should coincide with general location of planned intake and outfall structures.

(2) The distribution and time of residency of migratory or transient species and forms (age of development--clam larvae) should be identified as a distinct part of the inventory.

(3) Survey periods will be required to coincide with the four main quarters of the biologic year in order to ascertain and assess the free-swimming periods of the more important organisms.

Sampling conditions shall include the various representative physical, chemical, and biological conditions which are known to exist during each quarter.

(4) After species determination has been accomplished, demonstrate that the installation and operation of the proposed plant will have no adverse effects on the described aquatic biota.

2. Fresh Water Sites

It is presumed that complete offstream cooling will be provided at all fresh water thermal power plant sites. However, it is recognized that other treated plant wastes may be discharged and that certain operation modes may result in short-term heat discharges; therefore, the following data will be necessary for evaluation of thermal power plant sites on fresh water streams and impoundments.

A. Power Plant Data

(1) Specific location of the site.

(2) Description of other important water uses within the area of concern.

(3) Initial and ultimate generating capacity and proposed plan of power generation.

(4) Fuel and thermal efficiency.

(5) Cooling water requirements and mode of waste heat treatment.

(6) Power plant intake and outfall locations with recommendations for design of intake screening facility.

(7) Treatment requirements for plant make-up water and modes of treatment and disposal for plant waste waters.

(8) Mode of fouling control in the intake conduit and the waste heat treatment facility.

B. Physical Data

(1) Meteorological data for the plant site. The following continuous records will be required at the plant site over a period of two years, for correlation with long-term regional data: wind speed, and direction, air temperature, dewpoint, and solar radiation.

(2) Stream cross-sections, at one-mile intervals, from five miles upstream to fifteen miles downstream of the power plant site. Impoundment contours, where applicable, at five-foot vertical intervals.

(3) Hydrographs of daily stream flows for median and ten-year recurring low-flow years; also representative patterns of diurnal variation where the stream flow is subjected to regulation and/or tidal effects. These flows should be estimated for probable future flow regulation conditions in the years 1980 and 2000.

(4) Continuous water temperature records over a period of two years at the power plant site, five miles upstream, and fifteen

miles downstream. Special temperature surveys should be conducted to determine the presence and extent of temperature gradients affected by flow regulation, tides, or other causes. Thermographs in impoundments should be placed at the plant site, mouths of major tributaries, and other selected points to establish the general temperature pattern for a period of two years.

C. Chemical Data

Chemical water quality surveys should be conducted every three months with cross-sectional samples taken at the plant site, five miles upstream and fifteen miles downstream. Samples should be collected at the surface and at ten-foot intervals over the water column in impoundments at stations located at one-half mile intervals within the study area. Analyses included should define: (1) needs for plant makeup water treatment requirements; (2) impact, relative to Water Quality Standards, of radioactive, chemical, thermal, sanitary, and miscellaneous plant waste discharges.

D. Biological Data

Again, careful documentation of the receiving water biota is essential, since the Water Quality Standards were developed to protect this resource.

(1) Description of the proximity of the power plant site to major fish migration routes.

(2) Inventory and seasonal occurrence of resident and migratory fish within five miles upstream and downstream of the intake/outfall lines.

(3) Inventory and seasonal occurrence of the principal plankters present at the power plant site.

PRE-CONSTRUCTION AND OPERATIONAL MONITORING STUDIES

The above site selection information will be used as the basis for a decision on site approval. This approval represents the opinion that the site characteristics are amenable to protection of the aquatic environment and compliance with Water Quality Standards. The purpose of the pre-construction and operational monitoring studies is to facilitate final waste treatment, intake and outfall design, and to document aquatic environmental effects of the operating plant. The general format of these studies will be similar to the preliminary studies, but will emphasize specific data needed for plant design decisions.